INSTALLATIONS AND WATERSHEDS: An Examination of Changes in Water Management on Army Installations

Bryan G. Norton
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Army Environmental Policy Institute
101 Marietta Street, Suite 3120
Atlanta, Georgia 30303-2720

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EXECUTIVE SUMMARY

The Department of Defense and the Army have officially joined the Clean Water Action Plan (CWAP), a federal program that enhances efforts to fulfill the original goals of the Clean Water Act and strongly advocates watershed management. The Army is preparing a plan to address the action items listed in the CWAP and to institute watershed management on all Army installations.

Although this plan has yet to be completed, a significant number of Army installations have already begun to participate in local and regional watershed planning and have formed off-site partnerships to develop watershed-wide strategies for protecting waters.

These efforts are expressions of a growing trend toward "holistic" management of land and natural resources. Land and resource managers are looking beyond traditional property lines and participating in "ecosystem management" programs.

Two forces are driving this trend. First, because increasing human populations with access to more powerful technologies are creating more complex environmental problems, policy makers and environmental managers have begun to adopt system-wide approaches. Second, the growing insistence of interest groups and stakeholders on having a role in the development and implementation of policies has underscored the fact that environmental policies must be responsive to the values of human communities.

The goal of holistic ecosystem management is to manage natural resources in the context of a dynamic system. Watershed management is a special case of ecosystem management in which the system to be managed is defined in terms of water-relevant boundaries.

The Army and its installations will face at least four important challenges in implementing watershed management.

Challenge I: Developing a unified yet flexible Army policy for watershed management.

As noted above, numerous installations have begun participating in local watershed management plans. The nature of these efforts has varied widely, largely because of variations in local conditions. In formulating a unified policy, the Army needs to say something general that will be applicable to all of these many and varied bottom-up efforts without spelling out what watershed management *must* be in each individual case and without stifling creativity.

Strategy: The best course of action will be to move relatively quickly to state very general and open-ended authorizations for local managers to form promising partnerships, and then to develop an ongoing dialogue up and down the command structure so that refinements of these general rules can be the result of two-way communication, experimentation with various approaches, and sharing of information both across installations and throughout the command structure.

Challenge II: Preparing to respond to a new Environmental Protection Agency (EPA) regulatory regime for water quality and new storm water regulations.

Although the CWAP involves no new legislation, it does involve more effective enforcement of existing legislative mandates. These include (1) a new EPA regulatory regime focusing directly on improving water quality by ensuring that Total Maximum Daily Loads (TMDLs) are set for regulated pollutants in impaired streams, and (2) new Storm Water II regulations, which involve tighter regulation of non-point source pollutants. The changeover from technology-based permitting to quality-based permitting poses significant risks of higher regulatory costs and, in some cases, even threats to Army mission commitments.

Strategy: Fortunately, there are proactive steps that can be taken. Acting consistently with the all-service commitment to CWAP holds open opportunities to avoid high costs of compliance and threats to missions, provided Army installations can, through forming partnerships, enlist all users in a watershed-wide effort to reduce, or at least distribute fairly, costs of regulation.

Challenge III: Effecting integration of existing Army programs through watershed management.

While many installation managers have proactively taken part in local and regional watershed/ecosystem management efforts, they have not necessarily achieved an ideal level of integration of on-site activities for environmental protection. A major difficulty is that environmental offices are understaffed and underfunded in carrying out existing policies, duties, and reporting requirements. A directive to practice ecosystem management is already in place. The addition of yet another unfunded directive to practice watershed management has the potential to cause confusion, especially if installation managers see these directives as involving different priorities or requiring different actions.

Strategy: Ecosystem management and watershed management need not be seen as conflicting. If watershed management is introduced not as an additional task, but as a new way to organize, simplify, streamline, and integrate existing responsibilities, watershed management might be the catalyst to reorganize and synthesize tasks, allowing the same staff to accomplish more with the same resources. This will require determining ways in which existing reporting and other requirements can be reduced and/or consolidated to allow more creative, integrated efforts to take the place of currently time-consuming command-and-control regulatory requirements.

Challenge IV: Providing resources—and flexibility in using resources—to allow installation managers to act effectively in varied local situations.

There is a long and unchallenged history of installation participation in planning and information-gathering processes in ecosystems and watersheds surrounding installations, yet many installation managers are unclear as to whether authorization exists for them to expend Army resources in off-site remediation and recovery projects. The current approach to providing resources, which often are mainly assigned to quite specific management problems and initiatives by the centralized command structure, may not allow sufficient flexibility for installation managers to participate actively in partnerships that undertake protection and restoration of watersheds off-base.

Strategy: Clarification of installation managers' responsibilities and authorizations is essential, especially as these affect managers' ability to form partnerships and to contribute to off-site protection and restoration projects that are given priority by watershed-wide local and regional management groups.

Recommendations

1. Headquarters should instruct environmental staffs at all facilities to set up simple water quality monitoring stations just upstream as well as downstream from their land on all significant streams and other waters entering the facility. If this is not done, the Army may be unprepared to protect itself from unfair and perhaps even impossible allocation of TMDL levels for key targets such as sediment loading.

2. Headquarters should instruct appropriate installation staff to initiate and maintain contact with state water regulators concerning the process of setting TMDL levels and allocations for streams passing

through Army installations. It is in the Army's interest for Army representatives to be involved—at least by gathering water quality data—in the process of developing and advocating TMDLs. Those allocations will determine the future of Army water management.

3. Headquarters should encourage each installation's environmental offices to integrate their new "Storm Water II" planning with their TMDL planning.

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ACRONYMS

ACE	Army Corps of Engineers
AEPI	Army Environmental Policy Institute
BAT	Best Available Technology
CFR	Code of Federal Regulations
CWA	Clean Water Act
CWAP	Clean Water Action Plan
DMVP	Decision Making and Valuation for Environmental Policy
DoD	Department of Defense
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
INRMP	Integrated Natural Resource Management Plan
NEPA	National Environmental Protection Agency
NRC	National Research Council
NSF	National Science Foundation
OACSIM	Office of the Assistant Chief of Staff for Installation Management
ODEP	Office of the Director of Environmental Programs
OPA	Oil Pollution Act
RACT	Reasonably Available Control Technology
SDWA	Safe Drinking Water Act
TJAG	The Judge Advocate General
TMDL	Total Maximum Daily Load of Pollution

1. INTRODUCTION

On February 19, 1998—the 25th anniversary of the Clean Water Act—the federal government launched the Clean Water Action Plan (CWAP) (http://www.cleanwater.gov/; http://www.epa.gov/owow/). The CWAP emphasizes the need to address polluted run-off, enhance natural resource stewardship, and protect public health by regulating waters that are sources of drinking water, and recommends using an integrated watershed-by-watershed approach to water resource management. The CWAP also emphasizes social aspects of water management, encouraging public participation, development of multi-agency and public-private partnerships, and improvement of information sources, endorsing the citizen's right to know regarding management planning issues.

The CWAP involves no new legislation; it is an enhancement of the efforts to fulfill the original goals of the Clean Water Act, and involves more effectively enforcing existing legislative mandates (see Appendix for a brief overview of existing legislative mandates, or see Sullivan, 1999 for more detail). While the Department of the Interior and the Department of Agriculture are the lead agencies for the CWAP, all federal agencies are expected to participate by developing and implementing plans to help revitalize the commitment to protecting water resources, and by reshaping their efforts to contribute to the emerging trend toward watershed management. The Department of Defense (DoD) has agreed to participate in the CWAP, and has designated the Army Corps of Engineers (ACE) to lead the DoD effort, which will specifically address 14 of the 111 key action items listed by the CWAP.

On June 11, 1999, the Deputy Assistant Secretary of the Army (Environment, Safety, and Occupational Health) signed a memorandum directing the Army to address the CWAP goals and to develop a plan to institute watershed management on all Army installations. The Army committee tasked with this is a team led by the Office of the As-

sistant Chief of Staff for Installation Management's (OACSIM's) Office of the Director of Environmental Programs (ODEP)-Conservation and involving the Office of the Deputy Assistant Secretary of the Army-Environment, Safety, and Occupational Health; the Office of the Assistant Secretary of the Army-Civil Works; the Office of the Chief of Engineers; the Office of the Deputy Chief of Staff for Operations and Plans; OACSIM-Planning and Operations; and ODEP-Compliance. Implementation of the task, however, has fallen significantly behind a planned schedule that would have completed four of the five steps toward an integrated approach to watershed management for the Army by April 1, 2000.

Nevertheless, the difficulties in articulating a unified policy have not kept installations and installation managers from participating in the development and implementation of watershed management plans for the watersheds in which their installations are located. Around the country, environmental managers on installations are recognizing the need to be proactive in watershed management, and these entrepreneurial managers have formed partnerships with other government agencies and with private groups to develop watershed-wide plans and strategies for protecting waters, and to do so without unduly restricting Army missions, especially training missions.

These efforts, however, have generally been ad hoc and problem-specific. The movement now is toward formulation and implementation of an Army-wide policy on watershed management.

One complication (which may in fact be an opportunity) is that most Army installations are currently involved in rewriting their Integrated Natural Resource Management Plans (INRMPs) to respond to the 1994 memorandum of the Under Secretary of Defense for Environmental Security, which dealt with ensuring that "ecosystem management becomes the basis for future management of DoD lands and waters." With a directive to practice ecosystem management in place, the addition of the not-yet-fully-implemented directive to practice watershed management has the potential to cause confusion, especially if installation managers see these directives as involving different priorities or requiring different actions. In fact,

however, ecosystem management and watershed management need not be seen as conflicting. Careful analysis and application of each of these forms of management could lead to a coordination of complementary efforts instead of confusion.

In this paper we will take a broad look at policy issues and opportunities for the Army as it faces four major challenges that must be met if a watershed policy is to be effectively implemented. Before addressing these four challenges, it will be helpful to define critical terms and explore the relationship between ecosystem management and watershed management.

2. DEFINITIONS AND EXPLANATIONS OF KEY TERMS

Over the past decade, increasing attention to systematic environmental impacts of local activities has led to a pervasive tendency toward "holistic" management of land and natural resources. This trend has encouraged land and resource managers to look beyond traditional property lines and to participate in "ecosystem management" programs.

At least two relatively independent forces are driving this trend. First, scientists—especially ecologists—have argued for decades that the elements of nature are closely related and that changes to any component of a natural system will set in motion further changes that will spread throughout that system. While this idea has been prominent for a long time among scientists and environmentalists, it has only recently been brought to bear on policy considerations. One of the reasons for this is that increasing human populations, with access to more powerful and pervasive technologies, have magnified impacts, creating more complex environmental problems that must be addressed systematically. As a result, policy makers and environmental managers are considering more seriously the interactive impacts of human activities.

Second, top-down, command-and-control regulation of human economic activities—characteristic of the 1970s and 1980s—has met with increasing resistance from various segments of the public, as interest groups and stakeholders have begun to insist on having a role in the development and implementation of policies.

If one wishes to understand the trend toward ecosystem management, it is especially important to recognize the existence of this second force. To recognize only the first force, deriving from ecology and related sciences, would be to overemphasize the scientific aspects of the movement toward ecosystem management. A balanced view sees ecosystem management as a social and political trend toward using science to identify problems and possible solutions that

emerge on a systematic level, with the goal of managing natural resources in the context of a dynamic system that is constantly changing in response to natural and, increasingly, human-driven changes. Watershed management is one example of this broader trend toward a holistic, system-wide approach.

One of the implications of holistic management understood in this way is that it must be responsive to the values of human communities. These values—and the strategies developed in response to them—will differ depending on the complex relationships that have evolved between natural systems and the particular human communities they support. For example, in the Yellowstone area, where water is relatively abundant and where maintaining healthy populations of popular wildlife species is a dominant concern, watershed management may be a lesser (though still important) aspect of holistic management. By contrast, in a heavily used estuary such as the Chesapeake Bay, which is downstream from a huge amount of agricultural, industrial, and other human activities, issues of run-off and water quality dominate environmental policy decisions and, here, watershed management may be the unifying strategy of holistic ecosystem management. In an arid region such as the San Pedro River Valley in New Mexico, the most reasonable approach to holistic ecosystem management will focus most urgently on water use and conservation issues.

Thus, the strategies of holistic management are highly variable, and are dependent upon the complex interplay between human values and activities and the availability—in terms of both abundance and limits—of natural resources to support them. Although holistic management can take several forms, all the forms express a common commitment to a system-wide understanding of environmental impacts and ways of dealing with them. This common commitment is evident in the key terms found in the lexicon of holistic management.

2.1 Ecosystem Management

An ecosystem is a dynamic community of biological organisms, including humans, and the physical environment in which they interact. Ecosystem management is a proactive, goal-driven approach to sustaining ecosystems and their values. It involves identifying the boundaries of the relevant biological community and tailoring actions and policies to protect the system at all of the levels of organization embedded in it.

The goal of ecosystem management as applied to Army installations and lands is to manage ecological communities to promote regional environmental values and sustain the ecosystems within which those lands are located (adapted from US ACE, 1996, pp. 2-8; also see Army Regulation, 200-3, 1995). Ecosystem management involving participation in ecosystem management partnerships has been official Army policy since 1996. It represents a significant departure from a hitherto uniform Army policy of limiting non-civil-works Army activities to projects on Army land. Ecosystem management has already required installation managers to begin to look beyond fence boundaries.

2.2 Adaptive Management

Ecosystem management is sometimes associated with, even used interchangeably with, *adaptive management*; indeed, some might consider the phrase "adaptive ecosystem management" to be redundant. But it is useful to have and use both terms because, whereas references to "ecosystem management" denote the identification of an ecologically relevant *boundary* and *components* of the system under management, "adaptive management" has more to do with the *management style* associated with successful system-level management.

The phrase "adaptive management" was introduced into the literature by the ecologist C. S. Holling (1978; Gunderson, Holling and Light, 1995; Walters, 1986; Lee, 1993). Holling and his col-

leagues noted that, when managing environmental resources within a complex, dynamic system, it is impossible to define in advance such goals as "sustainability," "protecting system resilience/integrity/ health," etc. This observation follows from the fact that effects of human actions cannot be fully foreseen, especially as these effects cascade through different scales of complex systems, and it implies that ecosystem-level management must necessarily include an on-going and iterative process whereby policies can be reviewed and revised in the face of new evidence. Further, it suggests that, since uncertainty is an inevitable aspect of whole-system management, careful observation and policy experiments should be undertaken to provide a basis for revising hypotheses relevant to management and for reconsidering policy goals.

2.3 Watershed Management

Watershed management is a special case of ecosystem management, referring to ecosystem management processes in which the system to be managed is defined hydrologically as an area of land within which all surface waters flow to a single point. Watershed management begins with an identification of system boundaries, of the area necessary to adequately scope, analyze, and manage related water and land resources (Fuhrman, 1999). Watershed management is based on a recognition of the fact that all biological organisms and human communities need fresh water. It involves understanding interrelated problems within a system from the viewpoint of what affects water quality, quantity, and flows.

While water concerns are important in all environmental management situations, it is possible to define ecosystems according to boundaries other than watershed boundaries. The fact is that system boundaries do not exist in isolation, independent of management concerns and goals. Watershed management is appropriate when managers direct their attention to holistic impacts of water use and diversion, and to water quality effects of human activities. However,

ecosystem management could be undertaken with other environmental problems paramount, in which case boundaries might be specified in alternative ways. For example, in the case of the Yellowstone region mentioned above, where wildlife populations are given paramount importance in environmental management, the boundaries of management units are determined by the territorial limits of the most wide-ranging animals inhabiting the system.

Even watershed boundaries themselves are not "fixed" geographic realities, independent of human interpretation. Since watersheds form basins of many different sizes and scales, it is not possible to count a specific number of "watersheds" over a given region. For example, the Little Tennessee River watershed is a part of the Tennessee River system, which has its own watershed, and both of these are a part of the vast Mississippi River watershed.

It is important not to think of "ecosystem" and "watershed" as purely physical terms. The area chosen to bound a watershed is at least partly a function of the management concerns and problems identified. The choice of a management unit is also highly dependent on the jurisdictions of government agents and the coalitions they form with other government and private partners (Wuichet, 1995). When used in the context of environmental management, choice of a management unit is at least partly problem-driven. One can think holistically by identifying the largest management unit as an aggregate of various "wholes." This "polycentric" view is not unique to the term "watershed," since it can apply equally to the term "ecosystem" (Ostrom, 1998).

The current emphasis, embodied in the CWAP, on watershed management represents a recognition of the central importance of water to all life forms and to life systems. The call for watershed management, then, can be thought of as urging that, for all ecosystem management efforts, water be used as one important and integrating factor in systemic management and that, at least in some situations, there be a commitment to define holistic management units—ecosystems—with water-relevant boundaries, and to equate a healthy system with one that protects the integrity of its water bodies.

In its 1999 report on strategies for America's watersheds, the National Research Council (NRC) notes that, when used in the context of management—and specifically ecosystem management—"watershed" refers to a drainage area along with its associated water, soils, vegetation, animals, land use, and human activities (NRC, pp. 37-38). But the report also states that the appropriate scale for a watershed management plan "depends on the physical, political, and resource conditions of the area of interest" (p. 15). Accordingly, watershed management processes will be formed at many different levels of the hydrological system, often in response to widely acknowledged concerns of water quality or quantity (http://www.epa.gov/OWOW/watershed/wa1/html).

2.4 Community Participation

One of the more important aspects of changed thinking regarding ecosystem management—and this applies also to adaptive management and watershed management—is an expanded approach to community participation in environmental decision making. Although public participation has been required in environmental decision making for several decades (NEPA, for example, requires public hearings as a routine part of the drafting of environmental impact statements), early approaches mainly solicited public opinion upon already-developed proposals, providing the public with an opportunity to comment on complete plans before they were finalized. Social science research, however, has shown that these forms of consultation at the end of a process create as many problems as they solve, since members of the public often distrust the basis for decisions already made (Shepherd and Bowler, 1997).

Today there is a movement toward more meaningful public participation at an earlier stage in policy development. This means providing earlier access to the process, inclusion of multiple viewpoints and inputs in planning decisions, and active participation by non-experts in the gathering and assessment of evidence, all coordi-

nated within an iterative, ongoing, and open public process. Especially, it means public discussion of policy goals, and an attempt to articulate and agree upon shared management objectives.

As previously mentioned, the trend toward ecosystem management is one that includes human beings and their activities as an important aspect of ecosystem processes. Indeed, because human and social values are important drivers of ecosystem change, truly holistic "management" of an ecosystem or a watershed must include management of human activities and impacts as well as of lands and waters as a complete system. This broadened conception, combined with the growing tendency of human communities to govern themselves cooperatively in supporting multiple values, as expressed by varied interest groups, has favored the development of temporary and ongoing community groups.

The shift to an expanded approach to public participation has highlighted an important lacuna in our understanding of environmental values and valuation. Because public participation has been thought of as a matter of presenting already-formed policy programs to the public for their one-time reaction, the methods that have been developed to test and measure the value commitments of the public are designed mainly to identify and count "preferences" of individual citizens. Most of these techniques were developed by economists, who are interested in *individual* preferences (untainted by discussion and group deliberation), and who understand individuals to have well-formed and fixed preferences for environmental commodities and amenities. Valuation, given these assumptions, has consisted of devising various methods by which to estimate individual preference as an individual's "willingness-to-pay" for an identifiable environmental "good," and to aggregate these individual preferences accurately to reflect the total economic value of a given environmental good (see, for example, Mitchell and Carson, 1989; Freeman, 1993).

If, however, one assumes that environmental preferences are not pre-existing, but rather require a process of discussion, deliberation, and group development (Slovik, 1995), and if one wishes to think of public input into decisions as an ongoing, participatory aspect of the decision-making process, then new methods will be re-

quired to articulate and measure environmental values as experienced by the public (Kempton, et al., 1995; Norton, 1998; Sagoff, 1998; Norton and Steinemann, under review; DMVP, http://199.223.18.220/ee/epa/wkshp.nsf). This is an area of active research, but an area where funding has been limited, because it has only recently been clearly recognized that traditional valuation techniques are of limited value for the purposes of public participation in decision-making processes. If public participation is to fulfill its promise as a guide to community values, there will have to be considerable improvement in social science methodology to measure social values as they relate to environmental regulation, protection, and restoration programs, especially as these values are expressed in a dynamic process of public deliberation and community decision making.

2.5 Stakeholders

A stakeholder, speaking generally, is any party who is affected by, or who cares about, a decision under discussion. Ecosystem management processes and watershed management plans increasingly use more or less formal methods to identify and encourage participation by members of interest and user groups.

On one level, this trend represents a way of encouraging and organizing expanded public participation; thinking in terms of stakeholders can often help to achieve greater inclusiveness in public decision processes.

But an emphasis on stakeholders has another important aspect. Responding to the issues involved in water and watershed management often requires some command of technical detail and complex scientific information, which makes effective involvement by most citizens problematic. Stakeholder groups that meet regularly with a management committee can often act as “bridges” or communicators between agency employees and experts, on the one hand, and the broader public on the other.

For example, scientific models might indicate that certain public demands are impossible to achieve. Whereas an agency representative trying to explain this impossibility to passionate advocates might encounter distrust, a representative of the interested group —one who has participated long enough in management committee work to gain some expertise in the science involved—may succeed in communicating the difficulties to less involved members of the group, thus serving as an effective educator when government employees and experts would fail.

It is advantageous to a community to have effective, however informal, processes to encourage a form of stakeholder participation. By enlisting passionate spokespersons for various viewpoints, the stakeholder approach can meld the advantages of "representation" with the advantages of a participatory form of democracy—with most citizens willing to accept the recommendations of spokespersons for their viewpoints, at least until they become passionate enough to join the process more actively themselves.

2.6 Social Learning

Perhaps the greatest advantage of cooperative and democratic participation by stakeholders—interest groups and interested parties—in a watershed management plan is that, when such participation is ongoing and involves cooperation among scientists, managers, and the interested public, there is an opportunity for "social learning," which is a key element of adaptive management. Social learning refers to a process by which communities and elements of communities —through discussion, disagreement, deliberation, and advocacy— gain deeper understanding of the systems within which they live.

Another advantage is that, when management committees and citizens advisory committees develop sufficient trust to engage real problems and face real uncertainties as a group, they begin to "take ownership" of both the problems and the uncertainties. This sense of trust and problem ownership by groups can sometimes allow impor-

tant experiments and pilot projects to be undertaken to reduce uncertainty and to adjust goals in the face of new evidence.

It has been argued persuasively by Funtowicz and Ravetz (1993) that participatory, adaptive environmental management involves a new role for science in the public process. They describe science that is embedded in a process of social learning and adaptive management as "mission-oriented" science. This type of science is designed to inform public processes. It involves a new, post-disciplinary approach to knowledge acquisition, an approach in which scientists, stakeholders, and agency staff represent an enlarged pool of "peer reviewers," reviewers who look at science as a means to solve social problems.

2.7 The Relationship between Ecosystem Management and Environmental Management

One thing should be clear from these definitions and explanations: the relationship between ecosystem management (a policy that is currently in the implementation stage throughout the Army as each installation works to adopt or revise its INRMP) and watershed management (which is being introduced as an apparently separate initiative) is a close one. The exact nature of that relationship, however, is subject to interpretation.

This much is surely true, even non-controversial: watershed management, as noted above, is a special case of ecosystem management; watershed management approaches to ecosystem management use hydrology to delineate the boundaries of the managed ecosystem, and they emphasize the integrative features of a water-oriented approach to managing large land systems.

One would no doubt find more controversy if one were to tout watershed management as the best ecosystem strategy—*in every case of ecosystem management*. In fact, on the question of whether all ecosystem management projects should follow the principles of watershed management, the views of ecosystem advocates range

along a continuum. At one end of the continuum, advocates insist that all good ecosystem management must be watershed-oriented, while at the other end, ecosystem advocates might just say that watershed management is a useful adjunct to ecosystem management, or that it is important in some cases, etc.

What does this mean with regard to Army policy? It means that the new DoD/federal directive to practice watershed management is at least complementary to the already-adopted Army policy of incorporating ecosystem management into installations' INRMPs. One might even go further, arguing that the directive to manage watersheds is really best seen as a clarification of the ecosystem management directive, instructing installations on *how* they should do ecosystem management. According to this interpretation, the watershed directive would simply instruct installations—as participants in a public, ecosystem management process—to use natural watersheds as boundaries, and to pay special attention to water quality and quantity issues in their ecosystem management procedures.

The National Research Council expresses this stronger point as follows: "Ecosystem management is difficult to put into practice because ecosystems are geographically difficult to define from a scientific standpoint, and even more troublesome from an administrative perspective because many citizens do not have a mental picture of such a system." It goes on to explain why it favors watershed-based ecosystem management: "A watershed, however, provides a logical boundary system and conceptual unit for ecosystem management because it is based on the geographic characteristics of the ecosystem's hydrology,...and thus recognizes the dominant role that water plays in the biological relationships" (NRC, p. 40).

As we shall see below, use of water as an integrating factor in ecosystem management can have important practical effects in terms of achieving managerial and cost efficiency as the Army responds to the challenges involved in implementing watershed management.

3. FOUR CHALLENGES

The Army and its installations will face at least four important challenges in implementing watershed management. Meeting each of these challenges will require some degree of Army involvement and action off-site and include partnering with other agencies and land managers. In some cases, effective cooperation with other agents in watershed management may require expanded authority and flexibility for installation managers.

This section deals with each of the four challenges, exploring their meaning and implications by using examples and case studies from recent and current Army land management practices and proposing strategies for responding to each challenge.

3.1 Challenge I

Developing a unified yet flexible Army policy for watershed management.

The greatest challenge facing the Army with regard to watershed management is that of articulating a *general* policy that is sufficiently specific to provide guidance and authorization to installation environmental managers, and yet sufficiently *flexible* to allow particular responses to highly variable local conditions.

The DoD and the Army are already committed to ecosystem management as a policy, and many of the principles and directives of ecosystem management apply to watershed management (see NRC, 1999, pp. 81-85, 247-56). It can thus be said that the Army is already, indirectly, embarked upon a shift toward watershed management. Nevertheless, it will be very important to provide general guidance and authorization to installations as they continue this process of shifting toward more holistic management of ecosystems and watersheds. This will not be easy.

As stated in the above-cited NRC report: "No single approach to watershed planning can fit the wide range of conditions present" in the various regions of the country. The lands of the United States are highly variable and each watershed faces particular problems and constraints due to differences in rainfall, topography, soil types, etc. Similarly, differing human communities that have evolved within watersheds have developed distinctive patterns of valuation and use for watersheds and the resources they contain. "These regional variations and human aspects significantly affect the functioning of watersheds, and managers must consider them when creating plans and regulations" (NRC, p. 56).

This statement, by a blue-ribbon National Research Council panel, identifies the crux of the problem faced by the Army in implementing watershed management: how to allow flexibility to deal with many variable local and regional situations as exemplified in watersheds, and yet to do so within the framework of a clear and defensible general policy administered from "Headquarters." Given the high degree of variation, it is extremely difficult to develop a uniform, Army-wide plan that can be formulated in a single document applicable to every installation.

Despite the difficulty of articulating a general policy for watershed management, however, it should not be inferred that nothing is happening with respect to watershed management in the Army. In fact, a number of installation managers throughout the country, perceiving the compelling need for watershed-scale solutions to mounting water problems, have participated in watershed planning, and have formed off-site partnerships to address water quality and quantity issues at a more holistic watershed level.

A good example is the case of Fort Huachuca, which is located in the San Pedro River Basin in New Mexico. The flow of the San Pedro, once perennial, is now intermittent, probably because of the large withdrawals from the river, but also because of removals from the groundwater aquifer that helps supply the river. The Fort is a major user of aquifer water, and stakeholders in the area recognize the importance of including the installation in watershed planning; there is considerable pressure on the installation commander to co-

operate in water conservation efforts. Pressure is coming from both federal and international bodies to restore the San Pedro because of its importance as a flyway for migratory waterfowl.

At the same time, there is accelerating growth in the valley, which has become an attractive retirement option, and relatively high unemployment is leading local leaders to seek industrial and other forms of development. Water budgets from several studies have shown that there is simply not enough water to sustain Fort activities and to support population and economic growth, especially while undertaking the restoration necessary to respond to wildlife habitat requirements (Gen, 2000).

This set of interlocked management problems, it is clear, cannot be fully resolved "within the fence line" of Fort Huachuca, and so the installation has become an active partner with other agencies and groups in addressing the severe problems of the watershed. For example, the Fort has joined other federal agencies in offering DoD support for an "alternative futures" study that will focus on socio-ecological features of the area. This study will provide important information input into planning discussions and decisions in the region. Further, the Fort has become a regional leader in the San Pedro Alliance, a watershed-oriented ecosystem management group (Gen, 2000).

Most areas of the country have organized some kind of watershed or basin management process. Twenty states have organized, or are in the process of organizing, their water management systems according to a watershed structure. Other states have more or less formal watershed management plans, and many local groups and agency committees have begun to act to protect watersheds. According to McClurg (1997), several hundred watershed management programs are under way in California alone.

One perplexing aspect of these organizational structures is that watersheds exist at multiple scales, with smaller ones nested within larger ones. In common usage, the term "watershed" suggests a relatively small drainage area, while a "river basin" usually refers to a very large area. But, as noted above, when used in a management context, "watershed" refers to a relevant, hydrologically defined

management unit. Considerable flexibility will have to be offered to local environmental managers to choose the right local and regional programs, and to form the right partnerships, a decision that is deeply affected by local problems and issues as well as by Army needs.

In most cases, environmental managers at installations have been able to—or could easily—find already-existing partnerships that are currently forming and meeting regularly. These organizations form in response to local problems and concerns, and there are already many examples in which environmental managers on installations have formed partnerships with government agencies, such as the U.S. Fish and Wildlife Service, to cooperate in wildlife management (at Fort Benning, for example), and with other non-governmental organizations, such as the Nature Conservancy, to pursue creative land-use solutions (at Fort Bragg, for example). The existence of such ecosystem management processes usually provides the opportunity for proactive installation managers to join forces with appropriately sized organizations. In many cases, Army leadership will not be required to initiate new organizational structures, allowing installation managers to concentrate on forming more specific partnerships to achieve particular goals, thus developing a respected presence in ongoing public deliberations.

A significant number of installations have already begun to participate in local watershed management plans, both by modifying some of their on-site management practices to fit with watershed-wide management goals and by joining partnerships with other land users in their watershed. We can refer to these initiatives as "bottom-up" watershed management efforts. In formulating a unified policy, the Army needs to say something general that will be applicable to all of these many and varied bottom-up efforts without spelling out what watershed management *must* be in each individual case and without stifling the creativity needed for effectiveness in local action.

In summary, it cannot be denied that the broad variation in local conditions—including variation in physical conditions as well as in social, economic, and political conditions—creates a challenge for the Army or for anyone else intending to articulate or mandate a sin-

gle general set of watershed management guidelines. This variation, and its associated problems, partially explains the slow pace of the ODEP-Conservation team's effort to develop a general Army policy for watershed management (Booker, 2000). But this same variation urges action at the Army Headquarters level; if no general principles and guidelines are stated at the outset, and if every installation develops its own approach to dealing with local watersheds, it may become impossible to administer the resulting system in a fair and meaningful manner.

The best course of action will be to move relatively quickly to state very general and open-ended authorizations for local managers to form promising partnerships, and then to develop an ongoing dialogue up and down the command structure so that refinements of these general rules can be the result of two-way communication, experimentation with various approaches, and sharing of information both horizontally across installations and vertically throughout the command structure.

3.2 Challenge II

Preparing to respond to a new Environmental Protection Agency (EPA) regulatory regime for water quality and new storm water regulations.

In August 1997, the EPA issued a Healthy Watershed Strategy as a way to advance the cause of clean water throughout the United States. States were required to prepare lists of streams with existing or expected pollution problems.

By early 1998, the EPA had taken action on all of the state lists of impaired streams. It stated that efforts to improve water quality had dramatically reduced water pollution and laid the foundation for further progress. Efforts up to that point had emphasized technology-based controls such as secondary treatment of sewage,

effluent limitation guidelines for industrial sources, and management practices for some non-point sources. The next stage of the strategy would focus directly on improving water quality by ensuring that Total Maximum Daily Loads (TMDLs) were set for regulated pollutants in all impaired streams. The EPA thus asked its state, local, and tribal partners to make the transition from a clean water program involving primarily technology-based controls (such as BAT— Best Available Technology—or RACT—Reasonably Available Control Technology) to a program involving water quality-based controls implemented within a watershed framework, with TMDLs determining management goals for all listed waters.

The TMDL process works as follows: Once states identify specific waters where problems exist or are expected, the states then set priorities regarding which streams will be addressed first, and allocate pollutant loadings among point and non-point sources affecting the streams. These priorities and loadings must be approved by the EPA. Point and non-point sources will then be required to reduce pollutants to achieve the allocated pollutant loadings through a wide variety of federal, state, tribal, and local authorities, programs, and initiatives (http://www.epa.gov/OWOW/tmdl/ratepace.html; http://www.epa.gov/OWOW/tmdl/docs.html; Holroyd, 2000; Mikulik, 2000).

The EPA has also changed regulation of storm water run-off, instituting Storm Water Phase II regulations that were published in the Federal Register on December 8, 1999. These changes will require coordination between storm water management and water quality regulation through TMDLs. For example, because sediment will be a target pollutant for many streams, control of storm water may be necessary to achieve TMDLs of sediment for given stream segments.

One important aspect of the new regulations is that, whereas most Army installations have been treated as industrial sites and regulated accordingly, many installations will now be classified as "small municipalities." Storm Water Phase II has increased the scope of regulation, bringing smaller units into the regulatory program. At the same time, the new approach is more flexible in particular cases,

requiring less across-the-board monitoring and allowing more targeted monitoring.

In the past, storm water was regulated through particular technology-based requirements. Storm Water II will require each municipality (and, by inference, those installations that are so considered) to develop plans for controlling storm water and reducing its impacts on water bodies. This process, which will involve a negotiated mix of engineering, structural, and source control measures, will require development of a comprehensive management strategy that addresses each specific source of sediment carried by storm water. The timetable for implementing these new regulations is as follows: Storm water regulations will be stated for MS-4 municipalities (which will be the classification of most Army installations) by December 2002, and the new permits will be issued in March 2003 (Mitchell, 2000).

States have primary responsibility for developing lists and TMDLs under section 303(d). Section 303(d)(1)(A) and the implementing regulations (40 CFR 130.7[b]) provide states with latitude in determining their own priorities for developing and implementing TMDLs (although the EPA retains the right to regulate in place of states which fail to comply, and in states where the EPA has been sued TMDLs will be set according to a schedule agreed upon in a consent decree). The flexibility offered to states, particularly by the priority ranking process of section 303(d)(1)(A), is a good opportunity for incorporating rotating basin or other watershed approaches into the TMDL process.

The move from technology-based regulation to quality-based regulation is being phased in over 8 to 13 years, on a watershed basis, and will in many cases require tighter regulation of non-point source pollutants. It is certain that a number of Army installations will be affected in the transition to the TMDL stage of enforcing the Clean Water Act (West, et al., 2000; Holroyd, 2000). In particular, the Army runs a significant risk that, once TMDLs are set for impaired streams that pass through Army land and pollutant loadings are allocated, a disproportionate burden for cleaning up the streams will be assigned to the Army. (This might be the case, for example, if

the Army allocation for a given pollutant were unreasonably low or if the state were to find it easier to demand action from a few large land managers rather than from many small ones.) Indeed, this risk could, in some cases, severely restrict training and other missions on some installations, especially those which are located in degraded watersheds.

It is important to note that the legal ramifications of the new guidelines, especially with regard to regulation by states or the EPA of non-point source pollutants on federal facilities, is unclear and in a state of flux. This is because the traditional exemption of the government and its agents from state penalties and private suits—sovereign immunity—has been called into question. It is not clear, for example, whether the EPA can enforce non-point source regulations on Army bases, or whether state attempts to do so would hold up in court proceedings. At present, Congress (in Section 3159 of the Defense Authorization Act for the current fiscal year) instructs the Army not to pay fines for violations without specific congressional authorization. This issue will probably remain unresolved until Congress passes new legislation clarifying the roles of the EPA and the states in regulating under the Clean Water Act (West, et al., 2000).

Even in the absence of clear liability, it may be worthwhile for the Army to proactively partner with other watershed users to achieve better water quality through cooperative action, spreading the costs of restoration over a larger contributing community. The new phase of regulation encourages partnerships and a variety of programs, including incentive programs. An example of such a program is funding provided to states by the federal government under the Clean Water Act, sections 106, 205(j) and 319(b) for state programs of integrated monitoring and management. While the Army cannot apply for these funds, partnering with state agencies may make such funds available for projects in the watershed. If the Army can offer in-kind contributions to these efforts, much might be accomplished to improve water quality throughout watersheds, avoiding costly regulation. Such successes would also guard against possible interruptions in the availability of land for training and other missions in degraded watersheds.

This second challenge, which will intensify as states shift into the TMDL phase and more streams come under stricter regulation, could pose significant risks of higher regulatory costs and, in some cases, even threats to Army missions. Fortunately, there are proactive steps that can be taken. Participation by Army staff in basin-level planning partnerships—a step that is already under way in many cases—can lead to joint efforts that will lower Army costs in dealing with TMDLs and minimize the possibility of restrictions being placed on Army missions. If creative action is taken by an installation in advance of TMDL enforcement, that installation will simultaneously be moving toward watershed management as mandated by DoD acceptance of the CWAP, reducing costs, and guarding against interruptions of training. Acting consistently with the all-service commitment to the CWAP thus holds open opportunities to avoid high costs of compliance and threats to missions, provided Army installations can, through forming partnerships, enlist all users in a watershed-wide effort to reduce, or at least distribute fairly, costs of regulation.

If the Army is to be ahead of the curve on the changeover from technology-based permitting to quality-based permitting, it must begin to take action now. A top-down commitment to institute effective watershed management in an 8 to 13 year time frame (counting from 1998) would require the almost-immediate initiation of involvement at the level of the Director of Training, whose planning has a horizon of ten years.

3.3 Challenge III

Effecting integration of existing Army programs through watershed management.

Use of watershed management as an integrating factor can help to achieve managerial and cost efficiency in ensuring the availability of Army lands for the support of training and other missions.

Watershed management is, above all, an *integrative* effort. It involves integration of environmental policies and procedures at the installation level, incorporating pollution control, storm water run-off, conservation, and land use efforts, and relating these to similar, off-site efforts in the larger community.

While many installation managers have proactively taken part in local and regional watershed/ecosystem management efforts, these are usually driven by a particular problem or problems that are important in that locale or region, such as sedimentation of streams (Fort Benning, for example), particular threatened or endangered species (such as the Red Cockaded Woodpecker management at Fort Bragg), or water shortages (Fort Huachuca). These efforts are integrative in the sense that they relate installation actions to similar off-site efforts, yet they can be accomplished without necessarily achieving integration of on-site aspects of environmental management. They may not, that is, succeed in integrating water use, pollution control, and land use on the facility itself. This is because a local installation's cooperation with existing community efforts is usually ad hoc and problem-specific. As a consequence, an installation manager may achieve cooperation with other agencies and private owners in a watershed management initiative without necessarily achieving an ideal level of integration of on-site activities for environmental protection.

Many installations have undertaken important integrated actions with other regional agencies and partners in protecting watersheds. This integration has probably progressed furthest in the Chesapeake Bay region, where the DoD has 56 installations (19 Army). Under a special DoD Initiative for Restoring and Protecting the Chesapeake (begun in 1984), the Army and the other services in the Chesapeake Bay watershed area have been involved in a basin-wide process of planning and watershed management that has been under way for decades (DoD, 1998). Army installations have developed a number of partnerships and work on off-site projects. Fort Belvoir in Northern Virginia and the Aberdeen Proving Grounds are often cited as examples of installations that have moved rapidly toward integrated on- and off-site management. The Chesapeake Bay

Initiative may serve as a guide to similar activities in less intensely used watersheds where, in most cases, there are still important steps necessary to accomplish on-site integration of water protection and restoration efforts.

Installation managers face a number of difficulties in achieving integration of policies on their sites. A major difficulty is that existing policies, duties, and reporting requirements often set more-than-full-time tasks for available employees. For example, the water manager on one base (Fort Benning) reported that a time-study of his activities and responsibilities showed that adequate completion of his current duties would take twice his working time.

Over the past few years, installation environmental offices have been squeezed between reductions in clerical/secretarial help and increases in reporting requirements. This often means that environmental managers must set priorities among their responsibilities. Faced with the introduction of watershed management as yet another set of requirements and obligations, personnel will find it difficult to accommodate and they will be forced to fit it into present priorities as best they can. Adding watershed management obligations to existing obligations is therefore unlikely to yield successful programs. Because reporting duties are mandated and readily monitored, they will no doubt take precedence over less specific and accountable instructions to "be proactive" regarding watershed management opportunities.

Watershed management—as was ecosystem management before it—is an unfunded requirement. In general, there is a danger that installation environmental offices will be overwhelmed with layer upon layer of unfunded directives, leaving the office ineffective in accomplishing its tasks. At this point, despite heavy existing regulatory commitments, many installations have been working on, or revising, their INRMPs and struggling to implement ecosystem management. If the DoD and Army Headquarters now ask them to "layer on" watershed management as a separate task—in addition to their existing obligations—that task will either be ignored or will cause a breakdown in the fulfillment of current responsibilities, not to speak of its negative impact on morale. This pessimistic assessment is based on the current reality in installation environmental offices.

What appears to be a bleak situation could, however, be considered an opportunity. If watershed management is introduced not as an additional task, but as a new way to organize, simplify, streamline, and integrate existing responsibilities, watershed management might be the catalyst to reorganize and synthesize tasks, allowing the same staff to accomplish more with the same resources. As noted by one environmental manager at an installation that has already experimented with off-site involvements in watershed planning, the adoption of a watershed management approach focuses efforts on a specific set of boundaries, making measurement of water quality and water quantity possible and meaningful; this consolidation of perspectives might encourage integration of management activities and lead to greater success in managing water *and setting a course toward broader success in environmental efforts.*

Watershed management, to be effective, must represent a new and more efficient way for Army environmental staff to do current tasks, rather than an addition to current tasks. This means that every effort must be made to integrate, from the start, watershed management and ecosystem management into the INRMP process (Booker, 2000). The ideal outcome would be for installation environmental offices to gain integration and greater flexibility by implementing watershed-based ecosystem management.

If such an approach is to be adopted, each installation will have to rethink its water and land-use policies. Even more important, it seems likely that a rethinking of the responsibilities of Army environmental personnel will be required. In order to free their time so that they can participate in watershed-level activities, less emphasis will have to be placed on record-keeping and on responses to command-and-control regulation. A successful transition of this type will require ongoing dialogue with higher policy-making levels both in Army Headquarters and the DoD.

3.4 Challenge IV

Providing resources—and flexibility in using resources—to allow installation managers to act effectively in varied local situations.

While there is a long and unchallenged history of installation participation in planning and information-gathering processes in ecosystems and watersheds surrounding installations, many installation managers are currently puzzled with respect to the extent of their authorization to participate in such activities. In particular, it is unclear whether authorization exists for installation managers to expend Army resources in off-site remediation and recovery projects. In some cases, installation managers who are anxious to abide by the directive to form partnerships in regional watershed management processes feel that their ability to be effective participants in these activities is limited by unclear authorization for various types of actions.

Lack of clarity regarding authorization has an effect on public perceptions of the Army's role. The case of Fort Huachuca's participation in regional management of the San Pedro illustrates this. While the San Pedro Alliance considers Fort Huachuca to be an important and positive partner in managing the watershed, opinion polling shows that many citizens and stakeholders in the San Pedro process, while asserting that individual installation staff are important contributors to partnerships, are highly skeptical of Army participation. For example, a number of participants have expressed the opinion that they doubt that installation staff, when participating in regional management decisions, can speak or "make deals" for the Army. They believe, in other words, that offers of participation and partnership by staff will be overridden by higher levels of the command structure (Gen, 2000). This assessment, whether accurate or not, clearly affects the ability of installation staff to develop and maintain effective partnerships.

Gen (2000), discussing ecosystem management at Fort Huachuca, asserts that there is a difficult tension between the local-

ism, democracy, openness, and cooperative action that are characteristic of local and regional ecosystem management processes, on the one hand, and the Army's hierarchical command structure on the other. However much truth there is to the public perception that local environmental staff on installations may be unable to follow through on negotiated partnerships and projects, it is undeniable that this tension will affect watershed management. In particular, it is not clear that the current approach to providing resources, which often are mainly assigned to quite specific management problems and initiatives by the centralized command structure, will allow sufficient flexibility for installation managers to participate actively in partnerships that undertake protection and restoration of watersheds off-base.

Some of these problems are inherent in any effort of a large and structured organization such as the Army to participate in bottom-up, place-based, regional efforts at resource management. One of the great advantages of both ecosystem management and watershed management is that they bring together representative stakeholders, who have often been at odds regarding management options, and create the opportunity for developing personal relationships, a sense of common mission, and interpersonal trust (Lee, 1993; Gunderson, Holling, and Light, 1995). This advantage of participatory management, however, can be compromised if some participants in the process are perceived by other participants as unable to deliver on promises made, or as unable to bind the groups they represent. So, a major challenge faced by the Army command structure is that of designing a process whereby reasonable top-down controls are in place, without rendering installation managers unable to negotiate creatively with other participants in bottom-up watershed management efforts.

It is difficult to see how this desirable state—of allowing installation managers to form partnerships, negotiate with other stakeholders, and develop creative programs responsive to local problems, and do so with a reasonable expectation that their agreements can be implemented—can be achieved unless there is further top-down clarification of exactly what types of participation in ex-

actly which watershed-wide activities will be supported by Headquarters.

For example, one attorney (Belfit, Army Environmental Center, Compliance Division) has posed the following question: Suppose that an installation manager recognizes an opportunity to reduce pollution in the watershed by contributing Army resources to off-site projects adopted by a partnership in which the installation is an active member; suppose too that this opportunity seems more cost effective than any projects that could be undertaken inside the installation fence line. Is the installation manager currently authorized to make such a contribution?

This question, indeed, turns out to be very much on the minds of land and installation managers. In several discussions with installation managers on ways in which they are responding to the directives to practice ecosystem and watershed management, this and related questions were inevitably raised. As long as uncertainty with regard to authorization exists, one can expect that installation managers will act cautiously in developing partnerships and also that there will be considerable variation in the extent to which installations act decisively in addressing local problems.

It should be noted that this question is currently being asked by a Working Group which is being informally managed by individuals within ODEP, and includes members of the ODEP-Conservation group, the Army Environmental Center, and the staff of the Judge Advocate General's (TJAG's) office, as well as others. At this writing, the Working Group is meeting informally while awaiting formal tasking, and no conclusions or guidelines are likely to be forthcoming soon (Robinette, TJAG, Army Environmental Law Division). Given the complexity of the situation outlined above, the answer to the question—as well as the eventual outcome of the Working Group—will be extremely important in determining the results of Army ecosystem management and watershed management efforts.

4. SUMMARY

The DoD and the Army have officially joined the Clean Water Action Plan, a federal program (led by the Department of Agriculture and the Department of Interior), which strongly advocates watershed management. Offices and installations of the Army are thereby directed to engage in local and regional partnerships to protect and restore watersheds.

While there has been little detailed guidance regarding how to achieve the goals articulated by Headquarters, many environmental and land managers on particular installations have already begun participation in local and regional management efforts. It appears, then, that the Army, as represented on installations, has already taken steps to engage in "bottom-up" efforts at watershed management and that articulation and implementation of a "top-down" policy for watershed management are needed mainly to guide and authorize these ongoing practices. The difficulty is that, given the tremendous variability in the physical, social, economic, and political situations faced by installation managers in local and regional contexts, it will not be easy to articulate a general policy that allows sufficient flexibility for installation managers to act creatively, while retaining coherence and accountability in centralized management.

This review of policy issues and opportunities entailed by the new commitments to watershed management articulates four challenges that will be faced by the Army in implementing effective participation in local and regional watershed management efforts. These challenges are: (1) to achieve a unified and yet flexible general policy that will allow installation managers to respond to problems and opportunities with effective participation in local and regional watershed management efforts; (2) to prepare to respond, using the holistic management tools of watershed management, to new EPA regulatory regimes for water quality and storm water run-off; (3) to use the transition to watershed management as a means to integrate and streamline existing water programs in order to ensure the continued

availability of Army lands for training and other missions; and (4) to devise a plan for using resources that will allow installation managers to act creatively and effectively in varied local situations, while maintaining accountability for the use of those resources.

5. RECOMMENDATIONS

Based on the analysis in this paper, three immediate recommendations for action at the Headquarters level and four recommendations for further study can be offered.

5.1 Immediate Recommendations

1. Headquarters should instruct environmental staffs at all facilities to set up simple water quality monitoring stations just upstream as well as downstream from their land on all significant streams and other waters entering the facility. If this is not done, the Army may be unprepared to protect itself from unfair and perhaps even impossible allocation of TMDL levels for key targets such as sediment loading.

2. Headquarters should instruct appropriate installation staff to initiate and maintain contact with state water regulators concerning the process of setting TMDL levels and allocations for streams passing through Army installations. First, they must determine whether streams passing through their land are designated as priority clean-up sites on state lists. If a stream is on a state list, the process of setting TMDLs and allocations to land users is already under way. Setting TMDLs for other non-priority but "impaired" streams will come later, but it is in the Army's interest for Army representatives to be involved—at least by gathering water quality data upstream and downstream—in the process of developing and advocating TMDLs. Those allocations will have an impact on the future of Army water management.

3. Headquarters should encourage each installation's environmental offices to integrate their new "Storm Water II" planning with their TMDL planning. Since sediment is one of the TMDL target items for

many impaired streams, it is important to have a storm water plan that is consistent with, and capable of attaining compliance under, the TMDL allocations that are set by the states.

5.2 Recommendations for Further Study

1. There is a great need to clarify the responsibilities and authorizations of installation managers, especially as these affect managers' ability to form partnerships and to contribute to off-site protection and restoration projects that are given priority by watershed-wide local and regional management groups (see discussion of Challenge IV for reference to Working Group forming on this subject).

2. It will be important to study ways in which installations can shift and integrate responsibilities, taking into account the flexibilities offered by watershed management, and determining ways in which existing reporting and other requirements can be reduced to allow more creative, watershed-wide efforts to take the place of currently time-consuming command-and-control regulatory requirements.

3. It would be very useful to undertake a study, perhaps through questionnaires and/or interviews administered to environmental managers on installations, to determine what, and what kinds of, watershed management efforts have already been undertaken at installations across the country. In designing such a survey, it will be important to phrase questions carefully, because some activities that are inherently watershed-related may not be explicitly defined as such.

4. As noted above in the discussion of community participation, one area where new research is sorely needed is in the development of social science methodology to identify and measure social values relating to environmental programs, which is an essential step in setting democratically acceptable goals for community-based watershed

management. The shift to a more holistic, ongoing, community-based approach to management requires new approaches to the study of social values as they relate to environmental programs, one that evaluates management options in a dynamic situation with multiple, competing values. It is possible that the Army could, through sponsoring policy and valuational studies in watersheds where it is actively involved in community-based management, contribute to the development of better social science methods for studying social values and for engaging the social sciences in the search for goals for environmental protection, goals that are appropriate for holistic, community-based watershed management.

APPENDIX

Legislation/Regulations Governing Water Quality, Water Use, Land Use/Watershed Management

Legislative mandates to protect water resources derive from three important pieces of legislation (including applicable amendments subsequently added).

1. The first and most basic of these, today referred to as the **Clean Water Act (CWA)**, derives from the 1973 legislation, the "Federal Water Pollution Control Act," and has been subject to important amendments since. The CWA includes the following key elements:

(a) A prohibition of discharges, except as in compliance with Section 301 of the CWA.
(b) A permit program to authorize and regulate certain discharges (Section 402).
(c) A system for determining restrictions on regulated discharges (Sections 301, 306, 307).
(d) A process that defines cooperative state and federal implementation (Sections 401, 402).
(e) A system for preventing, reporting, and responding to spills (Section 311).
(f) A permit program governing the discharge/placement of dredged or fill material in the nation's waters (Section 404).
(g) Strong enforcement mechanisms (Sections 309, 505).

Important emendations and accretions to the CWA include the "Flannery Decree," 1976, by which the Environmental Protection Agency (EPA) shifted its focus mainly to the control of toxic releases, a trend that was strengthened with 1987 amendments establishing a program for addressing "Toxic Hot Spots." The Oil Pollution Act of 1990 (discussed below) revised and strengthened provisions dealing with oil spills in Section 311 and also created a

separate statutory program covering liabilities and compensation in connection with spills.

2. The **Oil Pollution Act (OPA)** of 1990 was passed in response to the Exxon Valdez tanker spill off the Alaskan coast. This act substantially strengthens CWA regulation of the oil transportation and storage industry, and makes parties responsible for facilities and vessels liable for the results of oil spills without regard to fault, subject only to a narrow range of defenses. Such parties are responsible for removal costs incurred by federal and state governments and by Indian tribes and also for compensatory damages, including damages to natural resources and real or personal property, subsistence use, lost revenues, profits and earning capacity, and public services. The OPA also abolished a number of separate funds that had been instituted to cover damages for spills of various sorts and set up a single fund, created from a five-cent tax on every barrel of oil received at a U.S. refinery, from fines for violations, and from funds subsequently recovered from responsible parties. While the OPA is often associated with tanker spills, it has very broad application to all manner of petroleum-based oil spills into U.S. waters.

3. Finally, the **Safe Drinking Water Act (SDWA)**, originally enacted in 1974, authorizes the EPA to regulate the provision of water for drinking and sets out regulations affecting water provision facilities. The SDWA originally authorized the EPA to regulate contaminants in public drinking water systems, instructing the Agency to establish national standards for levels of contaminants in public drinking water and to regulate underground injection and sole source aquifers. Due to slow implementation, Congress amended the SDWA in 1986, establishing maximum contaminant levels for a list of contaminants and accelerating the review of further contaminants; the 1986 amendments also strengthened enforcement. In 1996, the SDWA was again amended to increase the EPA's flexibility; these amendments emphasized prevention, ensured the consumer's "right-to-know," and provided funding for states and local water systems. Of particular interest to installation managers, the 1996 amendments

recognized small systems and brought them under regulation. The regulated entity under the SDWA is a *public water system,* which is defined as a "system for the provision of water to the public for human consumption through pipes or other constructed conveyances, if such system has at least fifteen service connections or regularly serves at least twenty-five individuals." Under this definition, many installations are subject to the regulations of the SDWA. It is important to understand that the SDWA deals with the *provision* of water for drinking—it therefore addresses water providers, making them responsible for the quality of water provided, *regardless of the source of contaminants.* The act, that is, does not deal with processes polluting water, which is the purpose of the CWA. Basically, two types of regulations apply to public water systems: National Primary Drinking Water Regulations and National Secondary Drinking Water Regulations. Primary Regulations are applied absolutely and set maximum contaminant levels for contaminants affecting health. Secondary Regulations deal with aesthetic properties of water, such as taste or smell, but are not enforceable under federal law. Some states have more stringent regulations for some contaminants, and in addition, some states enforce Secondary Regulations.

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